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THE LOGICAL-ANALYTIC METHOD IN PHILOSOPHY[1]

THIS is not the first time that a philosophical work, written in simple language and addressed to a wide public, has claimed for itself a revolutionary importance. It is indeed natural that the would-be revolutionist should seek the approval of the larger public, by way of appeal from the almost certain condemnation of the narrower technical public. Besides, the revolutionist has not a very high respect for the narrower public. He is frankly of the opinion that by far the greater part of its traditional pretensions are unfounded; and that a prosperous new beginning is better to be hoped for from those who are free from professional trammels. Descartes's "Discourse on Method" is the illustration *par excellence.*

In this volume, as in Descartes's great essay, it is a method that we are primarily called upon to examine—the "logical-analytic" method, as it is called. Mr. Russell writes: "This method, of which the first complete example is to be found in the writings of Frege, has gradually, in the course of actual research, increasingly forced itself upon me as something perfectly definite, capable of embodiment in maxims, and adequate, in all branches of philosophy, to yield whatever objective scientific knowledge it is possible to obtain" (p. v).

In order to understand the extent of this claim we should know what our author means by "philosophy." But upon this point no definite and consistent answer is given. "Philosophy" has long been for Mr. Russell an *extra word,* to which nothing in his thought accurately corresponds. When he wrote this book he was evidently drifting toward the identification of philosophy with logic, to which he later committed himself. In the Herbert Spencer lecture (delivered in November) he said: "Philosophy is the science of the possible"; and added: "Philosophy, if what has been said is correct, becomes indistinguishable from logic as that word has now come to be used" (p. 17). In the present volume he had said that "every philosophical problem, when it is subjected to the necessary analysis and purification, is found either to be not really philosophical at all [*sic*], or else to be, in the sense in which we are using the word, logical." The definite identification of logic and philosophy would, however, make nonsense of some of the most prominent theses. What is meant, for example, by the phrase, "all branches of philosophy," in the passage quoted above? Metaphysics and epistemology would seem to be included if anything is; but no one insists more strenuously than Mr. Russell that neither of these is to be included in, or confounded with, logic. And what becomes of the statement that "logic is the central study in philosophy," since "it gives the method of research in philosophy, just as mathematics gives the method in physics" (p. 239)?

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[1] Bertrand Russell, "Our Knowledge of the External World as a Field for Scientific Method in Philosophy." Chicago: Open Court Publishing Company. 1914. Pp. ix + 245. Reference is also made to Mr. Russell's essay, "The Relation of Sense-data to Physics," in *Scientia,* 1914, and to his Herbert Spencer Lecture on "Scientific Method in Philosophy," Oxford, 1914.

On the whole, we must be content to take the term "philosophy" somewhat loosely, as indicating those parts of what has traditionally been called "philosophy," which approach most closely the generality of logic. This is to be understood as excluding, for example, all questions which have "what is called a human interest," as falling within the scope of special sciences, and as having to be decided, if at all, by empirical evidence (p. 17). The exclusion of empirical evidence must not, however, be taken too strictly. Otherwise, on Mr. Russell's own principles, we are reduced to pure logic at once (p. 53).

The method for which so much is claimed is, in its broad outlines, that of Descartes, as explained in Part II. of the "Discourse on Method." The obvious problems, from which philosophy sets out, are invariably complex; and the initial data are complex and confused. These data are to be reduced to premises that are as nearly as possible simple, precise, and mutually independent. In this process of analysis, the original difficulty resolves itself into a number of questions of increasing abstractness. The analysis does not, however, proceed *ad infinitum.* There is a final stage in which difficulties vanish, and which is followed by a comparatively easy synthesis.

But there are differences from Descartes. For Descartes the process of analysis is a mere preliminary to the task of philosophy (or science), which is synthetic; whereas for Mr. Russell it is the analysis that is philosophical, while the synthesis is the work of mathematics—the term "mathematics" being taken, as he says, "in a somewhat liberal sense" (p. 211). For Descartes the analysis issues in a set of self-evident propositions. Mr. Russell recognizes that it may issue in propositions that are more or less open to doubt; and it may be added that he has elsewhere pointed out that in the case of logic the ultimate premises are less evident than many of their consequences, and hence rest on evidence that is essentially *inductive, i. e.,* on the fact that these later propositions can be deduced from them.

Mr. Russell's theory is further distinguished by his holding that the last stage of the analysis is performed in a manner very different from the preceding stages. "When everything has been done that can be done by method, a stage is reached where only direct philosophic vision can carry matters further. Here only genius will avail. What is wanted, as a rule, is some new effort of logical imagination, some glimpse of a possibility never conceived before, and then the direct perception that this possibility is realized in the case in question" (p. 241). In this connection we note Mr. Russell's view of the value of logic (in its recent developments) as an aid to the imagining of abstract hypotheses for examination. Until recently logic was so meager that it rather confined men's view of alternative possibilities, than broadened it. Now, however, "it gives the method of research in philosophy."

I believe that every competent judge will acknowledge the very great value of the logical-analytic method. What it has done for the systematization of the mathematical sciences is ample proof of that. I question, however, the accuracy of Mr. Russell's account of the method, and also his estimate of its value in philosophy.

1. To speak without qualification of "the very last stage of the analysis" is misleading. So far as we are aware there is no result of analysis that sets a definite limit to the process. This is so very well known to Mr. Russell that I wonder at his unguarded language. A particular analysis is concluded when indefinables and postulates are reached, which, after long study, we find ourselves unable to reduce or simplify. But the conclusion is only provisional. Moreover, there appears to be no thoroughgoing contrast between the last stage of an analysis and the preceding stages. The boundary-line between what can be done by method and what requires genius surely does not lie here. The whole process is a continuous one; and, as I have just remarked, what has for a time been regarded as final may well enough yield to further analysis. Again, there is no division, such as Mr. Russell's account suggests, between the work of analysis and that of synthesis. Every tentative analysis is at once tested by synthesis; and the synthesis may proceed until the analysis is shown to have been defective, *i. e.*, until contradictory conclusions are reached, or it is found impossible to infer from the assumptions in question some proposition that they were intended to prove. In such case a correction of the analysis is called for—a new labor of analysis. This alternation of analysis and synthesis may take five minutes or ten centuries; that is unessential.

2. The problem which the logical-analytic method undertakes to solve is never, so far as we know, limited to a single solution. In metrical geometry, for example, there is a very wide choice of indefinables. In logic itself the choice of indefinables is very free. And

the primitive propositions vary accordingly. Mr. Whitehead and Mr. Russell have, it is true, committed themselves to the view that the order of logic is at least so far determined that the theory of the implications of propositions must stand first. Even this appears to me to be very doubtful for reasons which I stated in a recent paper in this JOURNAL. It may be added that even if a unique solution of a logical-analytic problem were found, no method of showing its uniqueness is known.

Thus the knowledge which the logical-analytic method gives is not nearly so profound as at first sight appears. The simples to which it leads are only simple from the assumed point of view. They may from other points of view be of extraordinary complexity. In the case of logic this is so strikingly true, that the distinguished French logician, M. Louis Couturat, has come to the conclusion that the analytical problem admits of no solution of any value. Logic, he declares, must be content to remain illogical. I think that he exaggerates; but that there is some excuse for his opinion is evident from an examination of the "indefinables" of such a work as "Principia Mathematica." "Elementary proposition," and "elementary propositional function" are among the first that Mr. Whitehead and Mr. Russell introduce. The logical-analytic method must, in short, be used with the utmost caution, or it will give rise to the most serious illusions.

I may add that, so far as I am aware, no general method has yet been devised by which the results of alternative analyses can be combined in a single comprehensive and systematic statement.

3. How far modern logic may be of assistance in the use of the logical-analytic method I do not know. The method is, of course, used a great deal in the study of logic itself; and the experience thus gained is doubtless of value elsewhere; but I doubt whether it is much more valuable than a similar experience gained in arithmetic or geometry. Mr. Russell claims, however, that the knowledge of logical forms may be directly serviceable in philosophy, as an "inventory of possibilities, a repertory of abstractly tenable hypotheses,"[2] much as the more advanced parts of mathematics have provided an abstract framework for the physical sciences. In my opinion the value of logic as such an inventory is very slight, and the attempt so to use it must inevitably lead to a barren scholasticism—if not worse. It must be admitted, however, that sound logic is bound to be more helpful, and much less hurtful, than the unsound logic which our academic traditions still support. But, at the best, I gravely question whether the fitting of facts into frameworks is going to be the secure method of philosophy. Perhaps after we have considered Mr. Russell's theory

[2] Herbert Spencer Lecture, page 18.

of the construction of the physical world this questioning will not seem over-skeptical.

Before taking up any particular application of the method, a certain maxim, upon which Mr. Russell lays great stress, calls for comment. This is Occam's razor, "Entities are not to be multiplied without necessity"; which Mr. Russell more distinctly formulates as follows: "Wherever possible, logical constructions are to be substituted for inferred entities"; and which he declares to be the "supreme maxim in scientific philosophizing."[3]

This is, indeed, an important maxim, but it is not without its dangerous side. The fact that a certain logical construction has been effected does not by any means imply that the entities assumed at the beginning have any better claim to reality than those that have been replaced by the construction. It is not alone that the assumed entities may themselves be displaced by constructions in yet other terms. The original process of construction may, perhaps, be reversed, the entities which it discarded being now assumed as real, and those formerly assumed being thrown out as fictitious. At the same time, when a particular mode of construction is known, there is a very strong tendency to regard its order of logical priority as an objective order; and the rationalistic tradition is all in favor of yielding to this tendency. But to yield is to fall into fallacy. The only valid ground for holding to a single order of construction would be the indubitable fact, that the entities from which the start was made were directly given in our experience or could be safely inferred from entities so given. If a set of entities is assumed on insufficient evidence,[4] and the construction based upon them is persisted in obstinately and with disregard of the possibility of alternative constructions, a dangerous illusion results.

Now it is true that certain constructions can be based upon the bare assumption that something exists, no matter of what sort. But these constructions are confined to pure mathematics (including, of course, logic). All constructions that extend beyond the range of pure mathematics require the assumption of distinguishable and recognizable entities.

The only entities which Mr. Russell assumes as given, in his construction of the external world, are sense-data standing in certain relations (such as resemblance and some spatial and temporal relations). In addition, he accepts, as inferred entities—inferred from testimony, the validity of which rests ultimately on an argument from analogy—sense-data that are perceived by others; though he confesses that his scientific ideal would call for the questioning of this inference and the construction of a solipsistic universe. Furthermore, he accepts, as inferred entities, "*sensibilia*" (*i. e.*, entities which are sense-data, if some one is aware of them) of which no one is actually aware. In this latter case no hint of the mode of inference is anywhere given, and it may safely be said that, on Mr. Russell's principles, no inference affording any reasonable probability is possible. However, he speaks of these *sensibilia* as "a hypothetical scaffolding, to be used while the edifice of physics is being raised, though probably capable of being removed as soon as the edifice is completed."[5]

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[3] In the *Scientia* article, page 9.

[4] I purposely avoid the question, whether sufficient evidence is procurable; and also the further question, how, on the supposition that no such evidence is procurable, the common-sense notion of separate and independent existence may profitably be modified.

Let us consider this list of assumed entities, beginning with the unperceived *sensibilia.*

It may well appear strange that a set of entities, so doubtfully inferred, should be used in the construction of the physical world, of the existence of which we have none of us more than the very slenderest doubt. Mr. Russell gives as his reason "that the inferred entities should, wherever this can be done, be similar to those whose existence is given, rather than, like the Kantian *Dinge an sich,* something wholly remote from the data which nominally support the inference."[6] But the evident fact is that Mr. Russell's unperceived *sensibilia* are themselves mere *Dinge an sich.* Their resemblance to actual sense-data is a verbal figment. As Mr. Russell clearly states, our actual sense-data vary with a multitude of physical and physiological conditions. The sugar that is white to one sense is sweet to another; and the whole landscape changes color when looked at through blue spectacles. Now the unperceived *sensibilia* are *sensibilia* for which the physiological conditions of sense-data are absent; and, on Mr. Russell's principles, these conditions can not be supplied without changing the *sensibilia* themselves. They are not to be represented as colors or smells or tones or pressures, or even as pleasant or unpleasant. They must, with scientific prudence, be regarded as *at least* as different from all our sense-data, as cold is from middle C, or pain from a hue of the spectrum. Nay, they must be regarded as immeasurably more different. Even the statement that they *become* sense-data under certain conditions is an exaggeration. They become such *at most* as the white becomes sweet when you put the sugar in your mouth. There is no ascertainable or imaginable continuity. All that can properly be said is that they are *replaced* by sense-data under the appropriate conditions. They are things-in-themselves. And hence, in advance of any examination of Mr. Russell's construction of the physical world, we may confidently predict that every use that is made of these *sensibilia* must be fallacious. Several reviewers, who have identified Mr. Russell's standpoint with Berkeley's, have not done honor to Berkeley's memory.

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[5] *Scientia,* Vol. XVI, page 11.

[6] *Scientia,* Vol. XVI, page 10.

The assumption of sense-data as indubitably given entities stands upon a different footing; and though there are serious reasons for questioning it—which need no mention here—it has been, and still remains, an important working-hypothesis. If it be not strictly correct, it is at any rate very simple and facilitates a schematic description of important classes of facts. One merely deprecates the narrowness of outlook which would base upon such a foundation a scientific ideal of solipsism.

Here let me make one point clear. The assumption of sense-data may be taken to mean merely the assumption that there are entities (other than mental acts, let us say) of which we are directly and indubitably aware. Sometimes, I suspect, Mr. Russell intends no more than this. But when that is the case his theory of physics is left without support. If constructions are to have more than an abstract logical significance, the assumed entities must have definite character and interrelations. And so, of course, have the sense-data of Mr. Russell. For example, Mr. Russell adopts without the slightest hesitation a nativistic theory of visual space perception. By this I mean, not that he supposes we have an inborn capacity for seeing physical space-relations, but that, according to him, visual sense-data have spatial relations, such as inclusion and similarity of shape, which are psychologically primitive data of our knowledge. This, I say, he takes for granted as if it were an incontestable fact. The possibility that an experience of eye-movements is incorporated in the perception of such relations does not disturb him. Mr. Russell has read a fair amount of psychological literature, I believe; and he is ready with his contempt for those who, like Kant (p. 112), are ignorant of psychology. But, if I am right, he himself is far from having acquired good judgment in this field. And this is not to be wondered at. The discipline of psychology—the most empirical of sciences—and the discipline of mathematics are so divergent, that a real competence in both subjects is almost more than one man can hope for.

Let us turn to the illustrations of the logical-analytic method upon which Mr. Russell relies to show its value. These fall into two classes, one drawn from the field of pure mathematics, the other from that of physics.

The first class consists of Frege's general theory of cardinal numbers and Cantor's theory of infinite cardinal numbers and of continuity. These are assured accomplishments of the human spirit, and are indeed sufficient to show the value of the method in this field. Mr. Russell's account of Frege's theory—which was also independently worked out by Mr. Russell himself—is in his best style, simple and crystal-clear.[7] That of Cantor's theory is very incomplete, even so far as the essentials go; but I dare say that in a public lecture it would have been hard to do more. It is a great pity that no elementary presentation of this part of arithmetic has yet been published. Of all the newer developments of mathematics it is the one that calls for least in the way of previous knowledge, so that it lies within the reach of the ordinary sophomore; and its philosophical importance—if only in enabling us to avoid a host of common fallacies—is very great indeed.

The other class consists of the above-mentioned construction of the physical world—which gives its title to the volume—and a special analysis of the notion of cause. The latter I shall not have space to discuss. The former has been restated in a paper entitled "The Relation of Sense-Data to Physics,"[8] and as this is the version more especially intended for scholars I shall make frequent reference to it. It should be observed that Mr. Russell claims no finality for his theories; but he believes "that where they are found to require modification this will be discovered by substantially the same method as that which at present makes them appear probable"; and he offers them as illustrations of method. I shall take the theory of physical space for special examination, and shall try to make clear that, so far from being probable, it is altogether unsound, and only too well illustrates the insufficiency of mathematical methods in philosophy.

I am far from wishing to call in question the general position that the physical world is a construction, not an inference (as Mr. Russell has hitherto supposed). That is doubtless correct. Moreover, for the sake of argument, I propose to accept Mr. Russell's data and consider only the validity of the construction.

At the outset a certain superficial difference between the two accounts of the construction must be noticed. The account in the book confines itself, "for the sake of simplicity," to the sense of sight. The account in *Scientia* supposes that the correlation of the several sense-spaces into a single "private space" has been effected; and this private space, rather than mere visual space, is taken as the point of departure. The difference is of even less moment than might be supposed; for in *Scientia,* as in the book, it is by means of sight alone that the whole construction operates.[9]

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[7] One point calls for remark. Frege and Mr. Russell treat a cardinal number as a class of classes. They might equally well have treated it as a property of properties, *i. e.,* as a propositional function satisfied by propositional functions. It is quite as easy to define the "similarity" of two functions as the "similarity" of two collections (p. 204); and in the present state of mathematical logic I should suppose that there might be some convenience in this mode of procedure.

[8] Published last year in *Scientia.*

In a private space a collection of sense-data are ordered, which are called a "private world," or "perspective." The latter term is especially supposed *not* to suggest that there must be a percipient. The problem of the construction, as Mr. Russell views it, is: (1) To correlate as far as possible the contents of different private worlds; (2) to arrange perspectives in a three-dimensional, continuous (or approximately continuous) space; and (3) to correlate this "perspective-space" with the various private spaces.

(1) ". . . There is absolutely nothing which is seen by two minds simultaneously. When we say that two people see the same thing, we always find that, owing to difference of point of view, there are differences, however slight, between their immediate sensible objects" (p. 87). This assertion, as it stands, goes far beyond the evidence. It is indeed improbable that any two complex percepts, present to different minds, are exactly alike; but that the same elementary *sensibile* can not be a datum to two people at once is unproved. Mr. Russell might have assumed, as a working-hypothesis, that even though a *sensibile* present to one mind were exactly similar to a *sensibile* present to another mind, the *sensibilia* would be numerically distinct. Let us make this assumption, and proceed.

Two private worlds (we are told) may contain very similar *sensibilia,* arranged in an identical or closely similar fashion. This we know from testimony—the value of which we are assuming—as well as from our own movements. Hence it is often possible to correlate *by similarity* many contents of one perspective and many of another. *Sensibilia* thus correlated are called "appearances of one thing," the "thing" being the class of correlated *sensibilia.* For the sake of argument, let all this be granted.

(2) Private worlds, or perspectives, are now to be ordered by means of the *similarity of the correlated appearances.* "Suppose,

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[9] Mr. Russell evidently regards this emphasis upon vision as a mere matter of convenience, and believes that other senses might have served his turn as well. This last I will not dispute; but I will say that *the elimination of vision is the first requisite for an intelligent study of physical space.* The very fact that it can be eliminated—as in the experience of the congenitally blind—without in the slightest degree obscuring the geometrical properties of things, shows that it is a wholly unessential complication. On the other hand, there is, so far as we know, no independent visual space perception. It is impossible for us to eliminate from the visual experience the factors of touch and strain and flexion; though mathematical students of the subject will perhaps never be brought to comprehend this. But the visual factor can be eliminated; and it is, therefore, a matter of elementary scientific prudence to do so. The world in physical space is the blind man's world.

for example, that we start from one which has the appearance of a circular disk, such as would be called a penny, and suppose this appearance, in the perspective in question, is circular, not elliptic. We can then form a whole series of perspectives containing a graduated series of circular aspects of varying sizes: for this purpose we only have to move (as we say) towards the penny or away from it. The perspectives in which the penny looks circular will be said to lie on a straight line in perspective space, and their order on this line will be that of the size of the circular aspects. . . . It is to be remarked also that any other 'thing' than our penny might have been chosen to define the relations of our perspectives in perspective space, and that experience shows that the same spatial order of perspectives would have resulted'' (p. 90). The corresponding passage in *Scientia* adds: ''By such means, all those perspectives in which the penny presents a visual appearance can be arranged in a three-dimensional spatial order'' (p. 13).

There are criticisms of two kinds to be passed upon this construction; first, that it is theoretically inadequate; secondly, that it is impossible in practise.

(*a*) Comparatively few objects can be approached without change in their visual shape. The penny is an exception to the general rule; and though there are many exceptions the chance of hitting upon them is negligible. It is true that for small distances the change of shape is commonly slight; but it is also slight for a slight departure from the straight line. The consequence is that the space constructed must be less finely articulate than we should expect.[10]

Again, the observation of intersecting lines involves a turning of the head or eyes in order to sight objects in different directions. Strictly speaking, no perspective can be placed in two straight lines. This defect of the theory may, however, be corrected by regarding as the ''element'' of the space, not a perspective, but a class of perspectives, viz., those that are connected with one another by a simple turning-movement; such a movement being defined, say, as one that did not change the apparent size[11] of anything.

(*b*) Few ''points'' of perspective space are at any time occupied by minds. The knowledge of perspectives must be gained by movements in which they successively come into being and are given to our observation. Mr. Russell assumes, indeed, that very much the same perspective exists before and after it is perceived; but that anything comparable to visual sense-data exists where there are no eyes or nerves or brain-centers is, on his own principles, most improbable; and if they do exist they can not enter into the empirical construction. What must actually be ordered are visual worlds that are past and gone.

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[10] It may be added that the choice of the penny, while it is fortunate in one respect, is singularly unfortunate in another. If any other aspect than the circular were considered, the perspectives would occupy, not a straight line, but a roughly conical surface.

[11] To save myself from my friends I must say that this terminology is to me very objectionable, but that I am writing within the limits of Mr. Russell's theory.

Now, how shall such perspectives be recorded? Only by means of the visible shape of the object sighted. Every straight line explored must be labeled by an *exact drawing* of the visual form that defines it; and for different segments of the same straight line additional drawings must often be made. For to ensure comparisons of the requisite exactness mere memory could not be trusted. Again, as I have pointed out, the real unit of the space is the set of perspectives related by a simple turning-movement. For every "point" an elaborate set of drawings of the visual objects perceived in *all directions* must be made; only thus could the intersection of lines be noted. Does the reader realize what this means? Let him lift his eyes from the page and pass them slowly over the walls and ceilings and furniture of the room; and let him imagine the labor of making a full inventory of all that he sees. The inventory would have to be full; otherwise he could never count upon discovering the laws that govern the intersection of straight lines of perspectives. Then let him carefully turn his head, first around, then upwards and downwards, being careful to avoid any movement of translation; for the least shift would make a muddy space. And thus let him imagine the completion of his inventory—that it to say, his conception of a *single spatial element*. Next let him shift his head ever so little and hold it steady while he repeats the process; and so forth and so on. Now I realize that the patience and industry of many clever artists and many tireless tabulators can accomplish a good deal. But it seems to me that this particular task, if it be not absolutely impossible—and it is surely not far from that—is practically impossible; and the opinion hardens into conviction when I reflect that the whole rigmarole would have to be repeated in a great many different places. I am perfectly sure that all this is never going to be accomplished.

Now how damaging is this consideration to Mr. Russell's theory? It must, I should say, be regarded as altogether fatal to it. For the construction purports to be a possible foundation for physics, an empirical science; and if the operations which it calls for are practically impossible of execution, the whole enterprise falls to the ground. And that is not all. Mr. Russell's language betrays the fact that he believes this construction to represent approximately the (not wholly attentive) construction by which, as a matter of fact, the world in physical space has been built up. "Experience shows," he writes, in the passage quoted above,—assuming that there is such a body of experience. And in the corresponding passage in *Scientia* he writes: "Experience shows that the same spatial order of perspectives would have resulted if, instead of the penny, we had chosen any other thing which appeared in all the perspectives in question, or *any other method of utilizing* the differences between the appearances of the same things in different perspectives. *It is this empirical fact which has made it possible to construct the one all-embracing space of physics*" (p. 13).[12] Of course, no such body of experience exists. Mr. Russell has *deduced* his conclusion from his knowledge of physical space; nobody ever *induced* it.

(*c*) The final step of the construction offers no special difficulty. Each "thing" is correlated with the perspective that lies at the intersection of the various straight lines which its different "appearances" determine. Incidentally, however, Mr. Russell commits a blunder, which is in itself not worthy of notice, but which is interesting as showing how far Mr. Russell has been from distinctly imagining the procedure that he describes; for under favorable conditions men like him do not make mistakes in elementary geometry. Reverting to the penny, he says (p. 90): "We can form another straight line of perspectives in which the penny is seen end-on and looks like a straight line of a certain thickness."[13] Here "a certain thickness" is ambiguous; and according to the interpretation given to it the perspectives lie in a plane surface or in a circle—but not in a straight line.

The fact is, of course, that in the actual construction of physical space, as we see it take place in the experience of children, and as it has been further developed in the history of science, lines of perspectives played no part at all; and it has proceeded, not by comparison of visual shapes, but by *measurement*. Empirical geometry is primarily a metrical geometry, operating with, and upon, solid bodies. Now, it is, no doubt, abstractly possible that an entirely new system of experiments may be devised that will lead to the same result; but the probability is not great enough to be a guide of the scientific life. On the other hand, though the early history of metrical geometry is obscure, it is not difficult to draw up a series of experiments, conceived in its spirit, and sufficient for the construction of physical space. I have already given in outline a solution of this problem;[14] but the construction starts from assumptions very different from those of Mr. Russell.

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[12] Italics mine.

[13] Similarly, in *Scientia* (Vol. XVI, page 13): "Those perspectives in which the penny appears as a straight line of a certain thickness will similarly be placed upon a straight line."

[14] In "The Nature of Primary Qualities," *Philosophical Review*, 1913.

So much for the construction of space. I have chosen this point for special attention, not because it is the weakest in Mr. Russell's position, but because it is the most interesting. The weakest point, in my judgment, is the definition of matter. Let us look at this for a moment.

"We commonly assume that the information we get about a thing is more accurate when the thing is nearer. . . . Complete accuracy would only be attainable as a limit. . . . It is obvious that from the point of view of physics the appearances of a thing close to 'count' more than the appearances far off. We may therefore set up the following tentative definition: The *matter* of a given thing is the limit of its appearances as their distance from the thing diminishes. It seems probable that there is something in this definition, but it is not quite satisfactory, because empirically there is no such limit to be obtained from sense-data. The definition will have to be eked out by constructions and definitions. But probably it suggests the right direction in which to look."[15]

The facts here cited I should explain in a way that is utterly foreign to Mr. Russell's epistemology. But, without going into that, we may note that not only is no limit empirically obtainable, but there are marked exceptions to the uniformity of variation. An object brought too close to the eye loses in clearness; and though the tip of the nose is nearer the nervous centers than the tips of the fingers are, it does not feel so well. As for the suggested constructions, they must evidently be based upon assumed *sensibilia,* belonging to perspectives where no psychophysical organism exists. Here, as elsewhere, Mr. Russell overlooks the consideration that, if such perspectives exist, it is not to be presumed that they contain appearances that belong to distinct things in their vicinity. Without a multiplicity of sense-organs, how could there be more than a single *sensibile?* As I have said before, in dealing with such *sensibilia* no degree of continuity with our sense-data can be safely or legitimately assumed.

On the whole I should say that Mr. Russell's task of the construction of the physical world from sense-data is impossible of accomplishment. Even supposing that such sense-data, as he assumes, exist —instead of their being, as many psychologists hold, themselves a product of scientific construction—nevertheless their organization into a world wholly exceeds the power of science. The reason for this has been given by J. S. Mill. Berkeley had supposed that the laws of nature were observed uniformities in the order of our sensations. Mill pointed out that, from actual observation, no instance of such uniformity is known. In *no single instance* can I say: If I have such and such sensations (accurately describing them) then I shall have such and such sensations (accurately describing these also). The observable uniformities obtain between unities of a more complex sort, built up, in the main, not by processes of logical induction, but by association. In Mill's phrase, they obtain between groups of possibilities of sensation, that is to say, between things and events.

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[15] *Scientia,* Vol. XVI, page 16.

Mr. Russell's fundamental error lies right here. He writes, for example: "I think it may be laid down quite generally that, *in so far* as physics or common sense is verifiable, it must be capable of interpretation in terms of actual sense-data alone. The reason for this is simple. Verification consists always in the occurrence of an expected sense-datum" (p. 81). It never does. It consists in the observation of an expected material event. By rare exception an expected sense-datum may enter into the verification; but it is always in a definite material setting. Consider the example that Mr. Russell himself cites: "If I look at the moon on two nights a week apart, there is a very close causal connection between the two sense-data" (p. 82). It is obvious that the sense-data which one has a right to expect must vary greatly with physical conditions which can not themselves be resolved into terms of sense-data. The real causal connection is not between sense-data, but between the physical conditions at the two times, which might have been essentially the same, though the sense-data were very different.

There are several other features of Mr. Russell's construction that I should like to criticize if space permitted—for example, his conception of the nervous system, including the cerebral centers, as a transmitting medium of appearances, exactly analogous to "fog or smoke or colored glass."[16] But I am constrained to close and I do so with the statement, that, in my opinion this latest phase of Mr. Russell's philosophy is as complete and radical a failure as his ethical theory of a few years ago, which he has now discarded.

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THE METHOD OF PSYCHOLOGY

THE present is a strange and troubled time for psychology. After approximately a half century of development, the theoretical foundations of the subject are now widely and aggressively called in question. It is doubted by some whether consciousness is the subject-matter of the discipline, whether introspection is its method of research, or, for that matter, whether the department of thought, in its traditional form, is a science at all. Such drastic searching of heart can hardly fail to astonish those who remember the many conquests

[16] *Scientia,* Vol. XVI, page 4.